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EFFECTS OF AEROBICEXERCISE ON THE ECG LIMB LEADS AND AUGMENT LEADS OF OBESE UNDERGRADUATE STUDENTS OF UNIVERSITIES IN RIVERS STATE

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ABSTRACT
The purpose of this study was to determine the effects of aerobic exercise a stress test on the ECG leads and augmented leads of obese undergraduate male and females. Sixty-eight obese undergraduate students were purposively and randomly selected from three universities in Rivers state comprising of twenty-seven males and forty-one females were utilized for the study. The study adopted the pre-test post-test randomized group study design. A standard informed consent was used to seek their voluntary consent to participate in the study. Descriptive statistics were used to answer the research questions while analysis of covariance (ANCOVA) was used to determine the level of significance at 0.05. The result revealed that; (1) Significant increase in male leads II and III and non-significant decrease in lead I. The female showed significant dropped in leads II and III with non-significant dropped in lead I. (2) In the males there were no significant decrease in aVF with a non-significant increase in aVL and aVR, in the female there was significant increase in aVF with a non-significant dropped in aVL and aVR. Base on this outcome, the researcher recommended close monitoring of obese student before physical exercise are embark upon. It was also suggested that other aspects of the study be replicated in other parameters as well as categories of participants.

Keywords: limb leads, augmented leads, aerobic exercise and obesity.

Introduction

In recent times obesity has been on the increase generally due to the largely consumed junk foods provided by fast shops. Obesity according to Sweetney, (2007) is a medical condition in which excess body fat has accumulated to the extent that it may have negative effects on health, leading to reduced life expectancy and/or increased health problems. Also, Drenick, Bale & Johnson, 2001, stated that in advanced countries, people are considered obese when their body mass index (MBI), a measurement obtained by dividing a person's weight by the square of the person's height exceeds 30kg/$m^{2,}$ with the range 25-30kg/$m^{2,}$ defined as overweight. According to WHO, (2000), obesity increases the likelihood of various diseases, particularly heart disease, type2diabetes, obstructive sleep apnea, certain types of cancer, and osteoarthritis. Sweetney, (2007), stated further that obesity is most commonly caused by a combination of excessive food energy intake, lack of physical activity, and genetic susceptibility, although a few cases are caused primarily by genes, endocrine disorders, medications especially in psychiatric patients' medication . Evidence to support the view that, some obese people eat little yet gain weight due to slow metabolism is limited. On the average people have greater energy expenditure than their counterparts due to the energy required to maintain an increased body mass (Froelicher & Myers, 2000).

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The electrocardiogram (ECG) is the records of electrical activities of the heart. The limb leads, chest leads, the augmented leads, Lead segments and Leads intervals are of ECG cardiovascular variables that are prone to variations under physical activities. These waves measured in millimeters and seconds are the outcome of impulses generated as the heart contracts. The limbs leads and augmented leads are the only two categories of variables considered in this study.

Strenuous exercise generally is a severe test of homeostasis. Oxygen consumption and carbon dioxide production can increase to 10 times normal, mostly due to increased oxygen demand by the muscles (Shepard, 2009). Accordingly, Yan, et al., (2013) illustrated that, if we were insects, oxygen could diffuse directly to tissues via the tracheal tubes. But because we depend on our circulatory system to deliver oxygen to our tissues, this large increase in gas exchange is a circulatory system story. According to Guyton, (2006), blood flow to exercising muscles increases from about 1 L/min at rest to over 20 L/min. This tremendous increase in flow is called exercise hyperemia. Exercise hyperemia comes about mainly because the muscle capillary beds (normally about 20-25% open) all open up. This dramatic change is caused by local adaptation. While resting muscles are high in oxygen and low in carbon dioxide, most precapillary sphincters are contracted. However, when the muscle start consuming oxygen, the precapillary sphincters open and blood surges into all the muscle capillaries (Collis, et al., 2014).

According to Laughlin, (2009), a poorly-conditioned, sedentary person might only be able to increase his oxygen consumption 3 times (rather than 10 times in the trained athlete), mainly because of the circulatory system that can't carry as much blood to the muscles. This tremendous increase in oxygen consumption and carbon dioxide production has dramatic consequences for the circulatory system. Heart rate can triple, mainly because of an increase in heart rate, cardiac output increases by 5 times, or up to 7 times in the trained athlete (Shepard, 2009).This looked at cardiovascular responses to exercise in obese and largely sedentary undergraduate male and female students of universities in Rivers State of Nigeria.

Statement of the Problem

Muscles atrophy is cause by lack of exercise: that is shrinking and weakening of the muscles and accordingly increase susceptibility to physical injury(Amy, Janssen & Mark, 2008). Physical fitness according to Lopez, et al., (2009) is associated with immune system's functions; a reduction in physical fitness is generally accompanied by a weakening of the immune system. Furthermore, Goodman, (2005), stated that most cardiologists suggest that since illness or injury is associated with prolonged periods of in-active life style, such sedentariness has physiologically become linked to life-preserving metabolic and stress related responses, such as inflammation that aid recovery during illness and injuries, but, which due to being non adoptive during health may lead to chronic disease.

This study was boned against the backdrop of the fact that university undergraduate students portray largely sedentary life style, especially with the advent of different kinds of electronic devices now in vogue in the country. These sedentary activities are known to promote obesity and other health conditions among the populace. Sedentary life-style or inactive life-styles are all risk factors that can cause health problem or medical condition of obesity. This research study therefore ascertained campus life-style as it relates to this new endemic health problem among university students.

Research Method

Experimental research design was used for the study. The study adopted the experimental laboratory design, using pre-test/post-test randomize grouping to determine the effects of aerobic exercise, a stress test on the resting ECG of obese

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undergraduates students in Universities in Rivers State. The pre-test ECG values served as the resting (control) while, the post-test ECG served as the test values. This will give room to study closely between groups and between parameters. The area of the study was Rivers State of Nigeria. The population of this research comprised of all the third year undergraduate student males and females that are resident on campus, aged between 30 years and below from the three Universities, RUST, UPH and MADONNA who are registered for 2014/2015 academic season. A total of 68 participants, comprising of 27 males and 41females obese students were selected out of the estimated 18,200 targeted year three (300 level) students from a total of 85,500 population of the three universities according to the stated sources above. The students who have satisfied the conditions of the study were purposively selected for the study**.** Thus purposive sampling technique was adopted in selecting the participants for the study.

1. ECG machine, model; G58301, Manufacturer; General meditech, Inc. 2014.Component parts are, the limb leads, chest lead and gel. This model is relatively faster and has a screen display of recording as well as printing automatically, compare to older models.
2. Ergo metric Bicycle (Platinum Megatop; H.M. Energy). Very easy to maintain and monitor while in use.
3. Portable Couch (Vono). It is portable, it can be folded at the end of used and move to other positions.
4. Standiometer (Made in Germany; SECA). This is a two in one scale (weight in kilogram and height in meter).It is relatively less bulgy and is easily portable.
5. Tachometer, Cardio tachometer with multifunction Pedometers.

The major instrument used for this study was standard scientific equipment known worldwide in the scientific cycle. They were calibrated at the onset of each test and the values obtained were comparable with the standard values already known. This is to say the equipment already have worldwide standardization. To ensure adequate reliability, the instrument was administered on pre-test groups. The scores were correlated using Pearson product Moment Correlation Coefficient using the formula for computing (r).

Training of Research Assistants

Five research assistants were trained for the study, but only three were actually available. They were people who already competent knowledge of handling laboratory equipment. One assisted in Body mass index measurement, one assisted in the application of ECG gel and determination of blood pressure, while one assisted in supervising the ergo meter and Tachometer, the researcher personally place the ECG leads and operated the machine for the recordings as described in the experimental procedure below.

Experimental Procedures

Subjects were advised to relaxation prior to the study, wear light clothing and take their normal meals 2-3hrs before the study. The tests were divided into two parts referred to as Pre and Post Test. Each of the test consisting of Body Mass Index (BMI), as well as ECG measurements as follows;

1. The weights were determined using the standiometer scale in kilogram and the height in meters. The BMI is then determined by dividing the weight in kilogram by the square of the height. The BMI value was then determined by locating the status on the classification table, to determine if the subject was normal weight or obese. Only subjects that were obese proceeded to the next step of the experiment.

2. The second step was the ECG determination proper. With the assistance of trained research assistants, subjects were instructed to remove all the metals objects they wore and in possession, examples are watches, necklaces, earrings, rings, belts, mobile phones, etc. They were also asked if

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they had artificial teeth, iron in their legs or any part of their body as result of accident or whatever the reason, since these metallic objects could interfere with the process and cause errors in the ECG results. Subjects were instructed to lie down on the couch (hospital bed), facing upward (ventrally) while recording their data. Services of a qualified physician was hired for the periods of the study to handle any emergency that may arise. Recordings were carried out according to the specifications of the American Heart Association, with recording done at 25mm/sec, calibrated at 1omm/mv. The age-predicted maximal heart rate (HRMax) was first calculated using the formula, HRMax = 220 – 85% (sub maximal level) of this value is the heart rate the subject aims to achieve during the stress test (Ogedengbe, et al.; 2012).

ECG Recording

Placement of Electrodes

The placement of the first electrode which is C1 which is red in color is by locating the fourth (4th) intercostal space at the right side of the chest or at the fourth (4th) intercostal space to the right side of the sternum.

C2, C3, C4, C5 and C6 were all placed at the left side of the chest.

C2 is yellow in colour and was placed on the fourth (4th) intercostal space on the left side of the sternum.

C3 which is green in colour wasplaced midway between C2 and C4.

C4 which is brown in colour and was placed at the midst of C3 and C5 right under the nipple.

C5 which is black in colour placed at the anterior axillaries line at the same level as C4.

C6 which is purple in colour and placed at the axillaries line at the same level with C4 and C5.

The upper limbs which are the right and left hands were fixed next following the completion of the placement of chest leads C1 to C6.

The upper limb clipped with RR which is red in colour, was place at the right arm.

RL which is yellow in colour was placed at the ankle of the left arm.

Following the completion of the upper limbs electrodes the lower limbs were fixed next.

LL which is green in colour placed at the left leg.

LR which is neutral was placed at the right ankle of the leg.

The ECG machine was then switched on and allow for a few seconds. It is then check if the electrodes on the subject were placed properly and also check the wave lines appearing on the ECG machine if they were normal.

The ‘start’ button on the machine panel was then pressed and allowed to record and then the result was printed out for that subject as pre-test value. The subject then stated riding slowly and gradually increased the speed, until the attainment of 85% age-predicted HRMax or when exhausted and could not continue due to fatigue (modified McArdle protocol) (McArdle, et al., 1994). The subject at exhaustion was then asked to walk around the room slowly for a minute. The recordings of all the previous parameters were then repeated for the post-test values. The subjects who were included to participate gave their written informed consent for participating in the study. The study was done in according to the Helsinki Declaration of June 1964 and amended in Seoul in October 2008.

Precautionary Measures of Test Procedures

It was ensured that the ECG machine was turned off while fixing the electrodes, this was to avoid any shocks from naked leads ends.

It was also ensured that subjects do not have any metal on their body to avoid interference or false reading.

Hairs on the parts of subject’s body where the electrodes were to be placed were as a matter of fact shaved, especially in the male subjects, because most male subjects have body heirs. This is because heirs are poor conductors of electric currents, it would have

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reduced the heart current transmissions between the body and the ECG machine.

While carrying out the test, after placing the electrodes and clamps, the subjects were instructed not to move, laugh or try to stand up, move leg or arm as this would have interfere immediately recording thereby scattering the wave lines and may lead to false results. It was ensured that subjects were calm during the ECG examination. This experimental procedure was immediately repeated as soon as the subject has reached exhaustion on the ergometric bicycle.

Method of Data Collection

The subjects were approached on individual basis and the researcher explained the procedure of the test and that it was a non-invasive and painless procedure, the electrodes cannot generate enough electric current to cause shocks. Once they were convinced, they were requested to fill the consent form as stated above, their BMI were determined, the recording devices of the machine then put in place for recording study. Adequate instructions as state in the experimental procedure above as to how the subjects should conduct themselves was given before the actual commencement of the test.

Method for Data Analysis

Mean scores and standard deviations were used for answering the research questions. The hypotheses were tested using the analysis of covariance (ANCOVA) at 0.05 alpha levels. ANCOVA was suitable in testing the hypothesis since it serves as a procedure for determining the contingencies of multiple means which involves two independent estimation of the population variance. It was equally used in checking the homogeneity of variance between two samples. Hence Oyeka,(1992), emphasized that ANCOVA is used for partitioning the total variation of a set of data into several components. Furthermore, Onyeka,(1992) stated that ANCOVA is mainly used in testing hypotheses concerning population means and that it makes it possible to ascertain the proportion of the total variation attributable to each of variation in a set of data. In the same vain Owie, (2001) added that ANCOVA is used in experimental studies where the samples are normally or distributed, independent of each other and the variance of the population are equal. This is done by giving pre-test and post-test to all the groups, the data from the pre-test and post-test to all the groups, are then used to evaluate variation in the post-test data. In order to determine the direction of significance across groups in which F ratio was used.

Presentation and Analysis of Data

The main purpose of the study was to determine the effects of aerobic exercise on the ECG limbs leads and Augmented leads of obese undergraduate students in Rivers state of Nigeria. The results of the analysis of the student data are presented. The result attempted to answer the research questions and tested the hypothesis postulated for the study.

Decision Rule: the null hypothesis (Ho) is rejected if the probability value (P-value) given by the computer is less than the chosen significant level that is 5% or 0.05.

Research Question 1: What will be the effects of aerobic exercise on the ECG limb leads of obese undergraduate male and female students?

Table1a. The mean and standard deviation of male pre-test and post-test answer the question.

Column1	N5	male pre	Std. Deviation6	post male	Std. Deviation6

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		Mean		**Mean**	
I	27	33.5556	8.98432	32.7778	12.66835
II	27	51.7037	5.53878	25.5185	7.65290
III	27	23.8519	5.08167	10.7778	4.59375

Table 1b. The mean and standard deviation of female pre-test and post-test.

Column1	**N**	**female pre Mean**	**Std. Deviation**	**female post Mean**	**Std. Deviation**
I	41	43.6098	17.15354	57.0488	4.47186
II	41	60.6585	8.83632	21.4634	2.63721
III	41	21.9512	6.26878	22.4146	1.32241

Where

I --- Lead one

II --- Lead two

III --- Lead three

N --- Number of participants

The overall results in table 1 indicated that in female the mean scores for pre-test lead I shows increased 43.6098+17.15354 compared to post- test of 57.0488+4.47186, while lead II showed decreased in mean as 60.6585+8.85632 and 21.4634+2.63721 at the same time, lead II indicated an increased at post-test as 21.9512+6.26878 and 22.4146+1.32241 respectively,

In males, the result showed all decreased at post-test in lead II 32.7778+12.66835, 57.7037+5153878, 25,5185+7.65290 and 23.8519+519 10.7778+4.59375 for leads II and III respectively

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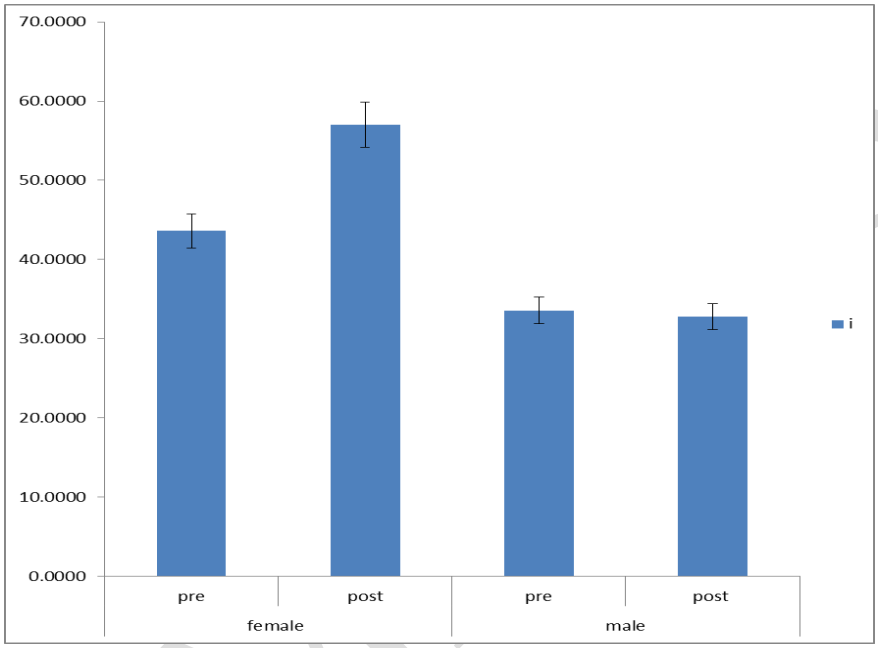


Figure 1a. Limb lead I of female and male.

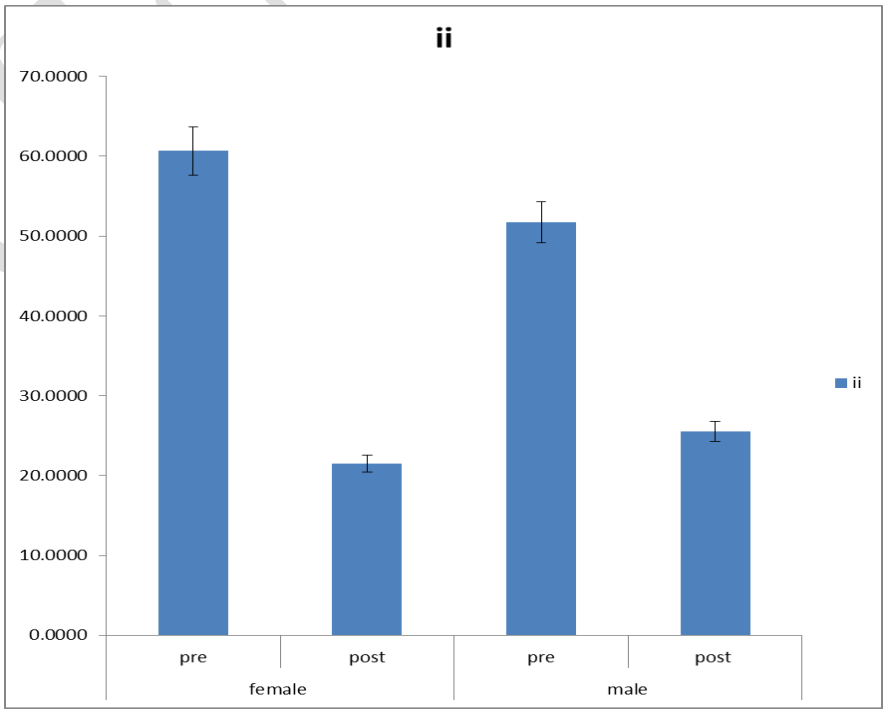


Figure 1b. Limb lead II of female and male.

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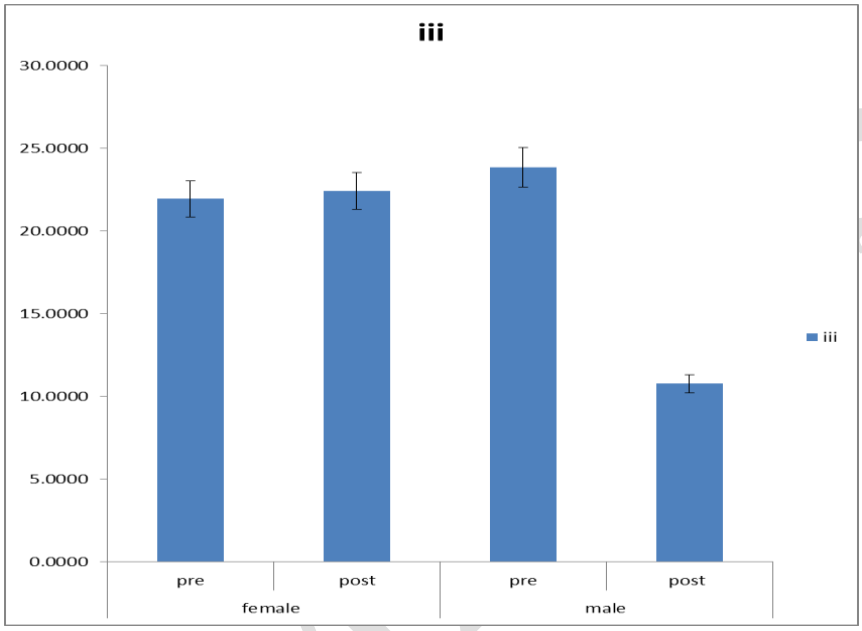


Figure 1c. Limb lead III of female and male.

This means that, there is inconsistency in the cardiovascular response as regards lead I and II in both females and males. However, lead I showed a consistent increased in response in both males and females.

Hypothesis 1: The analysis of covariance (ANCOVA) was done to determine the effects of aerobic exercise ECG limb lead in table 1a and 1b for male and female respectably.

Table 1d. ANCOVA summary on the cardiovascular response to aerobic exercise with regard to ECG limb leads of obese male participants

Column1	N5	male pre	male post	mean difference	P-value	Decision
I	27	33.5556	32.7778	-0.7778	.796	NS
II	27	51.7037	25.5185	-26.1852	<0.01	S
III	27	23.8519	10.7778	-13.0741	<0.01	S

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Table 1e. ANCOVA summary on the cardiovascular response to exercise with regard to

Column1	**N5**	**male pre Mean**	**Std. Deviation6**	**post male Mean**	**Std. Deviation6**
aVR	27	41.1111	4.65199	12.7778	4.76633
aVL	27	24.7407	6.21161	22.0741	7.35854
aVF	27	34.6667	8.33897	63.7037	5.96667

ECG limb leads of obese female participants.

Column1	N	female pre	female post	mean difference	P-value	decision
I	41	43.6098	57.0488	13.4390	<0.01	S
II	41	60.6585	21.4634	-39.1951	<0.01	S
III	41	21.9512	22.4146	0.4634	0.645	NS

The result in table 1a showed that lead I and II are significant at post-test, while lead III was not significant. While in table 1b the result showed no significant difference while both lead II and III showed significant responses.

Research Question 2: What will be the effects of aerobic exercise on the ECG Augmented leads of obese undergraduate male and female students?

Table 2a. Mean and standard deviations presented in table 3 answered this question.

Where, aVR……. Is Augmented leads with regard to right arm, aVL…… Is Augmented leads with regard to legs, aVF…… Is Augmented leads with regard to the foot.

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Column1	N	female pre Mean	Std. Deviation	female post Mean	Std. Deviation
aVR	41	48.2439	4.05451	14.5854	5.72266
aVL	41	11.9512	2.88055	10.0976	1.84126
aVF	41	34.5366	7.78491	67.7317	5.50919

Table 2b. Mean and standard deviations presented in table 3 answered this question

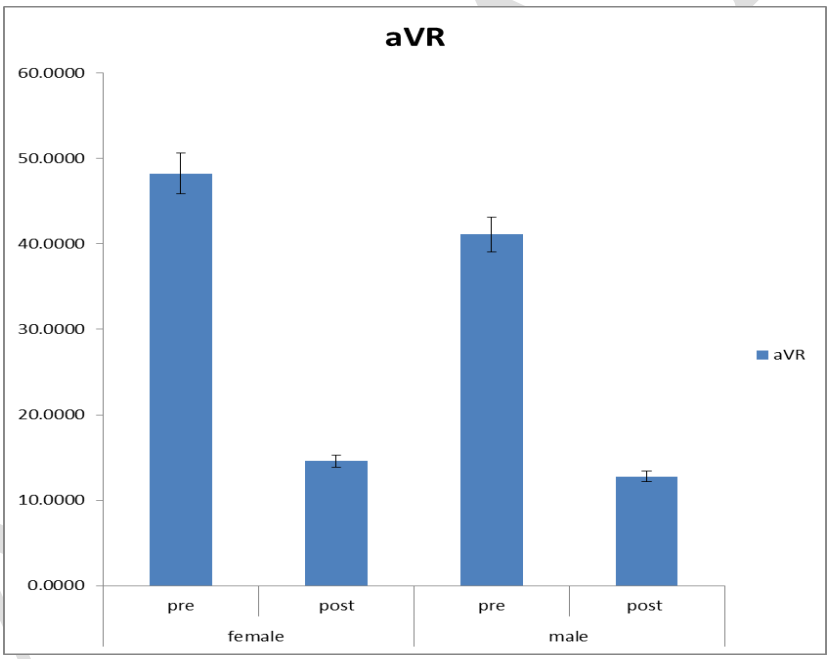


Figure 2a. aVR of female and male.

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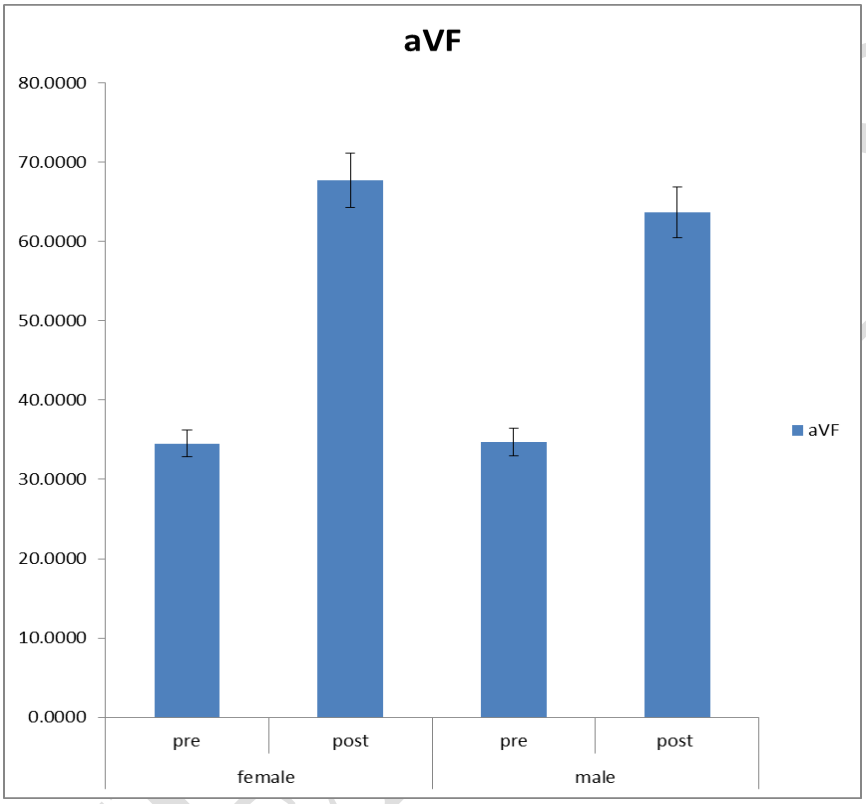


Figure 2b. aVF of female and male.

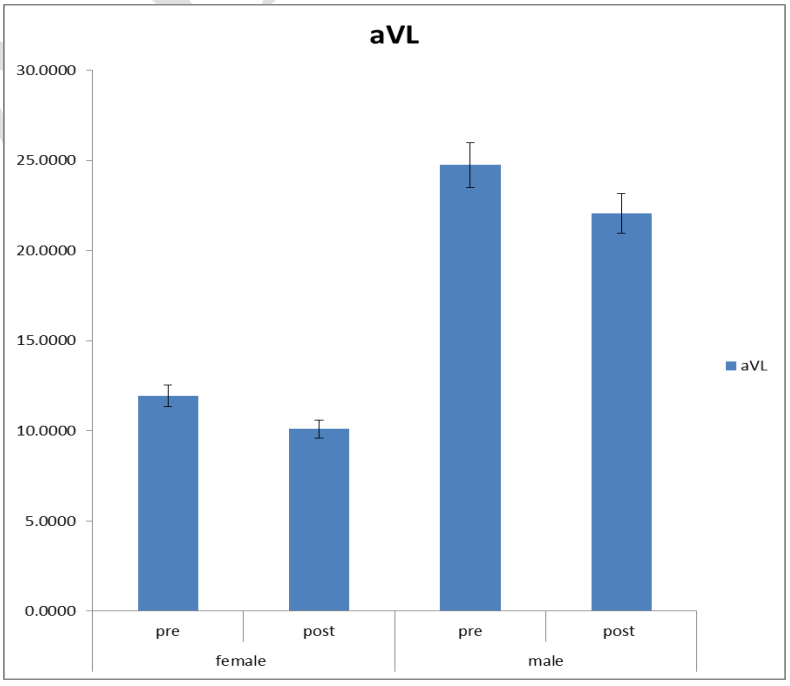


Figure 2c. aVL of female and male.

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The result indicated that the aVL means sharply dropped at post- test in both male and the female participants as follows; female 48. 2439+4.05451 pre-test, while 41.11 11+ 4.65199 at post-test and 12.7778+4.76633 for the male respectively. AVL in female at per-test 11.9512+2.88055 dropped at post-test as 10.0976+1.84126. In the male post-test was also observed in the values as follow pre-test 24.7407+6.21161 and 22.0741+35854. However, in aVF dropped in means at post-test were observed both males and the female mean is 34.5366+7.78491 male 34.6667+8.33897 and 63.7037+5.96667 pre-test and 67.7327+50919 at post-test. This means that cardiovascular parameters tested in this study as regards augmented level responded to exercise.

Hypothesis 2. There is no significant effects of aerobic exercise on theECG Augmented Leads of obese males and female undergraduate students in Rivers State.

The ANCOVA result analysis for this, is presented in table 2a and 2b for both males and females respectively.

Table 2c. ANCOVA Summary on the effects aerobiccardiovascular response to exercise with respect of Augmented ECG leads of obese male undergraduate students.

Column1	N5	male pre	post male	mean difference	P-value	decision
aVR	27	41.1111	12.7778	-28.3333	<0.01	S
aVL	27	24.7407	22.0741	-2.6667	.156	NS
aVF	27	34.6667	63.7037	29.0370	<0.01	S

Table 2d. ANCOVA Summary on the cardio vascular response with regard to Augmented ECG leads of obese female undergraduate student

Column1	**N**	female pre	female post	mean difference	P-value	Decision
aVR	41	48.2439	14.5854	-33.6585	<0.01	S
aVL	41	11.9512	10.0976	-1.8537	<0.01	S
aVF	41	34.5366	67.7317	33.1951	<0.01	S

Where, S… indicate significant and NS…… indicate not significant

The results indicated all the means scores of the variable where significant at post exercise except aVL in the male subject was not significant.

Discussion

The purpose of this study was to determine the effects aerobic exercise by obese undergraduate students of Universities in Rivers State of Nigeria. The electrocardiogram limb leads, I, II and III; Augmented leads, AVL, AVF and AVR; data were collected from obese male and female undergraduate student in three selected University in Rivers State and analysed using mean, standard deviation and ANCOVA.

Determination of the cardiovascular response of electrocardiogram (ECG) limb leads of

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obese male and female undergraduate student. Finding out the effects of aerobic exercise on the ECG limbs leads of obese male and female undergraduate student to exercise in Rivers State. Evaluating the effects of aerobic exercise ECG Augmented leads of obese male and female undergraduate students to exercise in Rivers State. Decreases were observant in lead I, II and III male participant at post- test. These decreased were significant at 0.05 levels when treated with ANCOVA. This is in collaboration with the work of Gerald, et al 2001, who reported decreased in post-test.

The results however, revealed decrease in only lead II and increases in leads I and III among the female participants. This is in line with the observation of Kligfield, et al 2006, who associated lack of decrease in limb lead III due to ischemia. The increase in the lead I was significant, but that of the lead III not significant. This increases in the lead I might be a general sign of ischemia in the female subjects. While decrease in limb lead generally one indication benefit of exercise (Simons, et al, 2015).

The effects of aerobic exercise in relation to ECG augmented leads of obese male and female undergraduate students in Rivers State. The study revealed decreases in aVR and aVL at post exercise, only aVL in the female was not significant. However, aVF were and both significant increase in male and female at post exercise. This according to Fletcher, et al 2001, are confirm signs of ischemic development usually in patient

Conclusion

Based on the findings of this study the following conclusions were drawn.

That exercise has effects on the ECG limb leads among male and female undergraduate students in Rivers State. The responses were significant in many leads except male leads I and female leads III. Response to exercise by male and female undergraduate students in Rivers State with regard to augmented leads except aVL in male was found to be non-significant.

Recommendations

Squeal to the result of this finding the researcher deems it necessary to recommend as follow. Undergraduate students should as a matter of fact check their body mass index regularly with a view to embarking on exercise at least twice a week or find time to take a walk every day in the morning especially those who are already obese.

The study is recommended as a vital document for cardiac rehabilitation practitioners in handling their patient diagnoses.

The researcher strongly recommended the out -come of this finding to physiotherapist working with their obese patients.

It is strongly recommendation to exercise physiologist and trainers as well as coaches to routinely consider checking cardiovascular parameters of their clients before any other consideration.

It is recommended to the ever fast growing gymnasia/ fitness centres across Nigeria.

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